

Anatomical Variations of Practical Importance in the Medial Cord of Brachial Plexus

Sabah Yaseen¹, Ashfaq ul Hassan², Rohul Afza¹, Nitya Waghray³

ABSTRACT

Introduction: Brachial Plexus is an Important Anatomic Entity. It is a plexus of nerves and variations in Origin of Nerves around this plexus is of utmost importance due to the practical implications of this plexus for modern interventional procedures done in this region. Aim of the present research was to study the variations in the branching pattern of medial cord of brachial plexus.

Material and methods: The present study was conducted at SKIMS Medical College, Department of Anatomy, Shadan Institute of medical sciences and Dr. V.R.K Women medical college, Hyderabad from 2012 to 2015 on properly embalmed and formalin fixed adult human cadavers during routine dissection practice for undergraduate students.

Result: The variations noted were significant. Variations were in the found in the formation of trunks, divisions, cords and terminal branches. All the variations are tabulated and presented.

Conclusion: The study found a definite variation in Number of branches arising from each cord as well as variations in the terminal branches of medial cord of brachial plexus like median, ulnar, musculocutaneous nerves.

Keywords: Medial, Median nerve, Plexus, Radial, Musculocutaneous, cord, Brachial, Variation.

INTRODUCTION

The article specifically deals with variations in the region of Medial Cord as the the brachial plexus may get injured due to trauma, compression or malignancy of the breast.¹ The traumatic cause of the brachial plexus injury are forceps delivery, gunshot or stab injuries, fall from height or automobile accidents. Compression of the plexus is usually due to aneurysm of the axillary artery. The brachial plexus may be injured due to the radiations of the axilla for breast cancer or by direct infiltration of malignant cells.^{2,3}

The brachial plexus is a complex network of nerves arising from nerve roots in the neck and continues by dividing into peripheral nerves in axilla. Brachial plexus has a complex structure and is in close relationship with the important anatomical structures. Anatomical variations in different parts of brachial plexus may attribute to unusual formation during the development of trunks, divisions or cords and these variations usually occur at the junction or separation of individual parts. The knowledge of detailed anatomy of brachial plexus along with its variations is of interest to anatomists, radiologists, neurosurgeons, neurologists, vascular surgeons, orthopedicians and anesthesiologists.³⁻⁵

The study aimed to record the variations in the branching pattern of medial cord of brachial plexus and to observe intercommunications between nerves of brachial plexus.

MATERIAL AND METHODS

The present study was conducted at SKIMS Medical College, Department of Anatomy, Shadan Institute of medical sciences and Dr. V.R.K Women medical college, Hyderabad from 2012 to 2015

A study was done on properly embalmed and formalin fixed adult human cadavers during routine dissection practice for undergraduate students at SKIMS Department of Anatomy, Shadan institute of Medical Sciences and Dr. V.R.K Women Medical college, Hyderabad during the period of 2012 to 2015.

The study was carried out on eighty brachial plexuses in axilla in forty adult human cadavers. Out of forty cadavers thirty were males and ten females and age group 30-70 years.

Instruments used

1. Scalpel – 6 inches in length with detachable pointed blades
2. Forceps – 4 inches in length: blunt forceps, fine forceps, toothed forceps.
3. Scissors – 10 inches long and straight with blunt tip
4. Gloves – 6 1/2 size
5. Cotton

Method

The dissection of axilla and arm was done according to the methods described by Romanes in Cunningham's Manual of Practical Anatomy. The skin, superficial and deep fascia of the pectoral and axillary region were incised and reflected. The pectoralis major muscle was cut across the clavicular head reflected laterally to its insertion. Pectoralis minor was removed at its origin and reflected superiorly. Loose connective tissue, fat and lymph nodes from the axilla were removed to expose its contents. The brachial plexus and axillary vessels were exposed. The various components of brachial plexus in this region were delineated by careful fine dissection. Adequate care was taken to preserve its relations to important surrounding structures. Brachial plexus was studied systematically, noting its pattern of branching and relationship to axillary artery. Inter communications between

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nerves of plexus were also noted.

Inclusion criteria

Adult formalin fixed cadavers irrespective of gender.
Age group varied in between 30 - 70 years.

Exclusion criteria

Cadavers of newborn, infants and children.
Cadavers in which axilla and upper limb is traumatised or with burns

RESULT

The observations recorded in the present study pertained to the meticulous dissection and naked eye examination of eighty human brachial plexus in axilla. It focused on variations of the medial cord of the brachial plexus. Out of forty cadavers dissected, variations in one or more forms was found in nine cadavers. In five cadavers variation was bilateral and in four cadavers it was found to be unilateral. All the variations were carefully observed and were recorded and tabulated under the following headings:

Number of cords

In seventy-nine out of eighty cases the number of cords observed, were three. Only in one case, two cords were found. The number of cords on right side were three in all forty cases whereas on left side normal number of cords were found in thirty-nine cases and in one case (2.5%) only two cords were found. Also the relation of cords with second part of axillary artery, on right side was normal in all forty cases and on left side it was normal in thirty-nine cases and variation was found in one case (2.5%). In this case instead of the lateral, medial and posterior cords, only two cords were present lateral and posterior to the second part of axillary artery. Lateral and medial cords fused to form a common cord which was lateral to second part of axillary artery. This common cord gave all the branches of medial and lateral cord. Posterior cord was present normally, posterior to second part of axillary artery and gave its branches in normal pattern.

Medial cord

Medial cord was found in seventy-nine cases and in one case it was united with lateral cord to form common cord. So medial cord was present in all forty cases on right side and in thirty-nine cases on left side. In all forty cases on right side, medial cord was found to have normal five branches, that are, medial pectoral, medial cutaneous nerve of forearm, medial cutaneous nerve of arm, medial root of median nerve and ulnar nerve (table-1). On left side thirty-nine cases had normal number of branches and in one case (2.5%), Medial cord was having only four branches and in this case medial root of median nerve was absent (figure-2) Medial cord was

lying medial to the second part of axillary artery in seventy-nine cases and lateral to the artery only in one case where it represented the common cord.

DISCUSSION

Anatomical variations of the peripheral nerves constitute a potentially important clinical and surgical issue (figure-2,3). Anomalies of brachial plexus and its terminal branches are not uncommon. They have been invariably studied and widely documented. Variations may occur in the formation of trunks, divisions, cords and terminal branches. In 1877 Walsh¹ described the variations in the formation of brachial plexus and also in its branches. He reported that 325 plexuses out of 350 he dissected, an additional head of ulnar nerve coming from lateral cord. This additional head was named as lateral head of ulnar nerve. He also observed

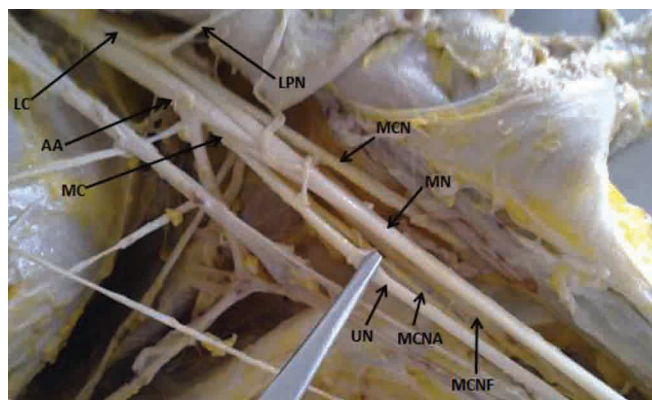


Figure-1 (cadaver 1, Left side): Showing normal anatomy and branches of medial and lateral cord. (LC-Lateral cord; MC-Medial cord; LPN-Lateral pectoral nerve; MCN-Musculocutaneous nerve; MN- Median nerve; UN-Ulnar nerve; MCNA-Medial cutaneous nerve of arm; MCNF-Medial cutaneous nerve of forearm; AA-Axillary artery)

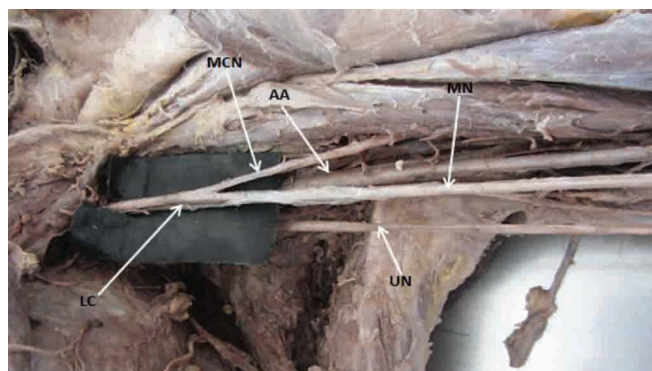


Figure-2 (Cadaver 6, Left side): Showing single lateral root of Median nerve with absent medial root. (LC-Lateral cord; MN- Median nerve; MCN- Musculocutaneous nerve; UN-Ulnar nerve; AA-Axillary artery)

Medial cord	Normal				Variation			
	Right		Left		Right		Left	
	No.	%	No.	%	No.	%	No.	%
Existence	40	100	39	97.5	Nil	0	1	2.5
No. of Branches	40	100	39	97.5	Nil	0	1	2.5
Relation to second part of Axillary artery (AA)	40	100	39	97.5	Nil	0	1	2.5

Table-1: Depicting normal pattern and variations of medial cord (MC)

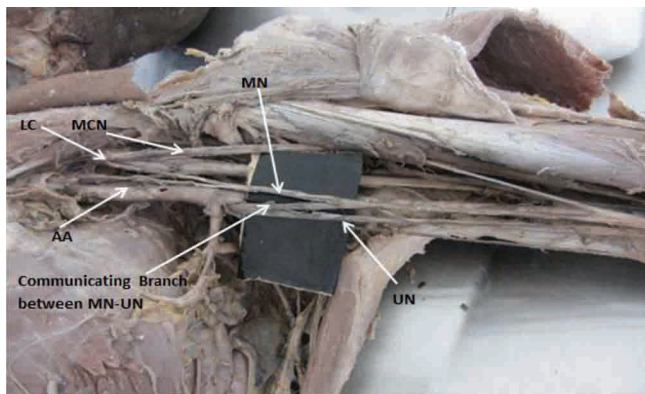


Figure-3 (Cadaver 22, Left side): Showing communication between Ulnar nerve and Median nerve. Two roots of Median nerve joining lateral to third part of Axillary artery. (LC-Lateral cord; MN- Median nerve; UN-Ulnar nerve; MCN-Musculocutaneous nerve; AA-Axillary artery)

a communicating branch between medial head of median nerve and lateral cord in 10 cases.

Herringham WP,² in 1887 conducted a study on 175 brachial plexuses and observed that in 36 plexuses there was no real posterior cord formed.

In 1904, G.E.Smith³ noted on dissection of adult male cadaver that on both sides, radial nerve gave a large branch immediately below the tendon of teres major, this split into two rami, one of which entered the upper part of the medial head of triceps and the other joined the ulnar nerve.

W. Harris⁴ in 1904 reported that in his study on 4 foetal and 26 adult cadavers he found a fine branch from ulnar nerve communicating with the medial cord in 36% of brachial plexuses. He also stated that he traced a branch which arises from medial cord and runs across the front of axillary artery, passes behind the lateral root of median nerve to join the nerve to coracobrachialis.

In 1939, Miller RA.⁵ reported in his study on arrangement of axillary artery and brachial plexus done on 480 upper extremities, that 8% cases had aberrant relationship.

In 1955 Buch-hansen K.⁶ reported a case in which the medial and lateral roots of the median nerve did not unite in the axillary fossa. Instead they united in the arm, 5 cms distal to the lower border of latissimus dorsi muscle.

In 1985, Watanabe M et al⁷ studied 140 upper limbs and found fusion of the musculocutaneous and the median nerve in two cases.

S.K. Pandey et al⁸ in 2004 studied the anomalies in the formation of the brachial plexus cords and median nerve on axillary region in 172 cadavers. The total incidence of anomaly was 12.8%. All the cords merged to form a common cord in 2.3% cadavers. Absence of the posterior cord was observed in 3.5% cadavers. Anomaly in the formation and course of the median nerve was observed in 7% cadavers.

In 2005, Gupta M et al⁹ reported a case of left upper limb of 35 year old male cadaver in which formation of Lateral cord was distal than usual, in relation to the second part of axillary artery behind the pectoralis minor muscle. Anterior division of middle trunk gave rise to the nerve to coracobrachialis and an additional lateral root of the median nerve. Communications were also found between additional

lateral root of the median nerve and medial root of the median nerve, medial root of median and ulnar nerve, ulnar and radial nerve.

Goyal N et al¹⁰ in 2005 reported a case of bilateral formation of median nerve by union of three roots. The additional root was lateral, on both sides. On left side it was arising from the anterior division of middle trunk and on right side it was contributed from the lateral cord.

In 2005, Srijit Das et al¹¹ reported a case of 55 year old male cadaver in which on right side lateral cord gave two roots to the median nerve. The upper branch united with the medial root of median nerve anterior to axillary artery. The median nerve thus formed was related medially to axillary artery.

Avinash Abhaya et al¹² in 2006 reported a case of 33 year old male cadaver in which the musculocutaneous nerve was having a dual origin. Variation of its origin, course and distribution was symmetrical bilaterally. The higher origin was reduced to a thin nerve and supplied only coracobrachialis muscle while the lower origin was of normal thickness, supplying other muscles.

Saeed M.A.M et al¹³ in 2007 reported a case of 65 year old male cadaver with two communicating branches from lateral cord to the medial root of the median nerve. The lateral cord, after receiving communication, bifurcated into two branches. The first division gave muscular branches while the second division formed lateral root of the median nerve.

In 2010, Jamuna M et al¹⁴ reported a variation in brachial plexus. Instead of lateral, medial and posterior cords only two cords, anterior and posterior were present lateral to the axillary artery. Anterior cord was represented by fusion of lateral and medial cords. musculocutaneous, median, ulnar, medial cutaneous nerve of arm and forearm originated from the anterior cord. Radial nerve and axillary nerve originated from posterior cord.

Ajay.R.Nene¹⁵ in 2010 reported a case of 65 year old male cadaver in which median nerve was formed by union of two roots posterior to the third part of axillary artery. The fork of the median nerve thus formed was hooked down by another fork formed by third part of axillary artery and one of its branch.

Flora M.F Taylor and associates¹⁶ in 2010 reported a case of a 45 year old male cadaver. In this case the musculocutaneous nerve was absent. Ulnar nerve was formed by lateral and posterior cords. The whole medial cord continued down as medial root of median nerve, which received a lateral root from the lateral cord. After giving lateral root of median nerve, the lateral cord gave off an additional branch that joined the posterior cord to form a short common trunk. This common trunk divided into two – one additional root for median nerve and second continued down as the ulnar nerve. Sinha R.S et al¹⁷ in 2012 studied forty upper limbs from twenty adult cadavers and observed 5% cases showed variant branching pattern of brachial plexus. In two cases axillary nerve arose from posterior division of upper trunk instead from the posterior cord. In three cases median nerve had an extra root. Communication between median and musculocutaneous nerve was seen in three cases.

Patil S.T et al¹⁸ in 2012 reported a case of adult male cadaver in which, on left side median nerve was formed from lateral

cord only. On right side a communicating branch from median nerve to musculocutaneous nerve was present.

Neelanjit K et al¹⁹ in 2013 reported that out of sixty upper limbs dissected by them, different types of communications between musculocutaneous and median nerve were observed in seven limbs. In two limbs median nerve was formed by three roots, two lateral and one medial. In one limb musculocutaneous nerve was absent and in another one limb musculocutaneous nerve was fused with median nerve.

In 2014 Priti Chaudhary et al²⁰ studied 60 upper limbs and reported only two branches from lateral cord in 10% cases, musculocutaneous nerve being absent. In 3% cases the medial cord had only four branches. In 1 case medial root of median nerve was not originating from medial cord and in another case medial cutaneous nerve of arm was not given by medial cord. In 3% cases posterior cord had only three branches where upper subscapular nerve and thoracodorsal nerve were not arising from posterior cord. In 10% cases four branches were present out of which in 5% cases upper subscapular nerve was absent, in 2% cases axillary nerve as absent and in 3% cases lower subscapular nerve was absent. Results of all the observations were observed in present study also but with percentage of variations varied. In present study two branches from lateral cord were observed in 1.25% case and four branches in 2.5% cases. Whereas three branches in 96.25% cases. In 98.75% cases branches from medial cord were normal, i.e, five and only in 1.25% cases four branches were observed. In posterior cord normal pattern of branching was observed in 97.5% cases where as two and four branches were seen in 1.25% cases each.

CONCLUSION

The anatomical variations in any region are important. Especially those in this region should be taken seriously into consideration by a clinician. The knowledge of detailed anatomy of brachial plexus along with its variations is of interest to anatomists, radiologists, neurosurgeons, neurologists, vascular surgeons, orthopedicians and anesthesiologists. The study found a definite variation in Number of branches arising from each cord as well as variations in the terminal branches of medial cord of brachial plexus like median, ulnar, musculocutaneous nerves.

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